

Surgical Assistance for Favorable Outcome Achieved through Presurgical Nasoalveolar Molding Using Innovative Impression Technique: A Case Report

Manu Rathee¹, Kuldeep Singh², Maqbul Alam³, Sanju Malik⁴

ABSTRACT

Aim: The aim of this case report is to highlight the importance of presurgical nasoalveolar molding (PNAM) in cleft lip and palate (CLP) cases and its impact on primary surgical outcomes.

Background: Cleft lip and palate (CLP) is one of the most common congenital malformations of the maxillofacial complex. Of all congenital malformations, it ranks third and has a multifactorial etiology. Such anomalies can have several consequences, such as impaired suckling, defective speech, deafness, malocclusion, gross facial deformity, and bring tremendous stress on the entire family. Surgical correction is required to restore the form and function of the affected area; however, surgery has to be usually deferred due to the age of the newborn patients.

Case description: A 12-day-old neonate born with a bilateral cleft of lip and alveolus was referred from the Department of Plastic Surgery. PNAM was planned in consultation with the plastic surgeon. A customized nasoalveolar molding plate was fabricated, and tissue molding was carried out. Following nasoalveolar molding, primary surgical repair was done.

Conclusion: Significant reduction in cleft width, approximation of soft tissue of the lip, and improvement in nasal tip alignment were achieved following PNAM. It favorably positioned the tissue segment and minimized the extent of the local tissue dissection and advancement. The synchronous prosthodontics and surgical treatment resulted in optimal treatment outcomes.

Clinical significance: The higher level of estrogen and hyaluronic acid in the newborn that remodels the cartilage can be utilized through the light application of forces, and hence hard and soft tissue molding can be achieved without surgery. PNAM acts as a promising adjunct prior to primary surgical closure of the CLP. Thus, PNAM immediately after the birth can serve to significantly augment the surgical outcomes and the extent and/or the number of surgeries can be reduced.

Keywords: Cleft lip and palate, Nasoalveolar molding, Newborn infant, Presurgical orthopedics.

International Journal of Clinical Pediatric Dentistry (2023); 10.5005/jp-journals-10005-2493

BACKGROUND

Clefts of lip and palate (CLP) are the result of improper or failure of fusion of left and right maxillary prominences during the 6–12 week of gestation. Patients affected with these anomalies faces several issues, such as feeding problems, frequent nasal regurgitation that may lead to aspiration pneumonia, deafness, and in later stages may result in malocclusion and gross facial deformity.^{1,2}

Various techniques have been advocated for presurgical infant orthopedics, such as Hoffman, Desault, Hull Hen, Brophy, and McNeil. Of the recent technique, the Grayson's technique includes PNAM of the lip and nose in infants born with CLP. Nasoalveolar molding consists of an intraoral molding plate and a nasal stent that will mold the alveolar ridge and nasal cartilage synchronously. The PNAM is employed with the objectives to reduce the size and severity of the cleft by aligning the maxillary complex, molding and approximating the soft tissues of the lip, and improving nasal tip projection, thus enabling the operating surgeon to achieve significantly improved surgical outcomes.³

CASE DESCRIPTION

A 12-day-old female neonate with a cleft lip and alveolus was referred from the Department of Plastic Surgery for the feeding management and presurgical molding of the cleft lip and alveolus. The patient's parents reported difficulty in feeding and

^{1,3,4}Department of Prosthodontics, Postgraduate Institute of Dental Sciences (Govt. Dental College and Hospital, Rohtak), Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India

²Department of Burns & Plastic Surgery, Pt. B.D. Sharma Post Graduate Institute of Medical Sciences (PGIMS), Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India

Corresponding Author: Maqbul Alam, Department of Prosthodontics, Postgraduate Institute of Dental Sciences (Govt. Dental College and Hospital, Rohtak), Pt. B.D. Sharma University of Health Sciences, Rohtak, Haryana, India, Phone: +91 7205572621, e-mail: maqbulalam41@gmail.com

How to cite this article: Rathee M, Singh K, Alam M, *et al.* Surgical Assistance for Favorable Outcome Achieved through Presurgical Nasoalveolar Molding Using Innovative Impression Technique: A Case Report. *Int J Clin Pediatr Dent* 2023;16(1):153–158.

Source of support: Nil

Conflict of interest: None

Patient consent statement: The author(s) have obtained written informed consent from the patient's parents/legal guardians for publication of the case report details and related images.

escapement of fluid through the nose. Detailed paternal and maternal family history was traced till the second generation but no significant finding was observed. There was no history

of maternal infection or trauma during the conception period till birth.

Extraoral examinations revealed a bilateral cleft of the upper lip with a complete cleft of the right alveolus (Figs 1A to C). Radiographic examination was done using radiovisiography, and a significant cleft was observed on the right paramedian area (Fig. 1D). Diagnosis of Veau's classification type III cleft of lip and alveolus was arrived. After discussion with the plastic surgeon, PNAM was planned using the Grayson method with a palatal plate accompanied by an approximation of extraoral soft tissue with taping and nasal stent. The surgical phase was planned at 4 months.

CLINICAL STEPS

Impression Making and Model Fabrication

The infant was seated comfortably in the head down position in the mother's lap. The material chosen for the impression was soft consistency addition silicone impression material (Zhermack Putty Soft, Zhermack, Italy). Muslin cloth was placed, covering the entire loaded impression material serving as a safety check against any dislodgement of impression material into the adjoining area of the nasal cavity or throat. Functional impression was obtained through reflex suckling movement (Figs 2A to C). Impression was poured to obtain the Master Stone model (Fig. 2D).

Designing and Fabrication of the Appliance

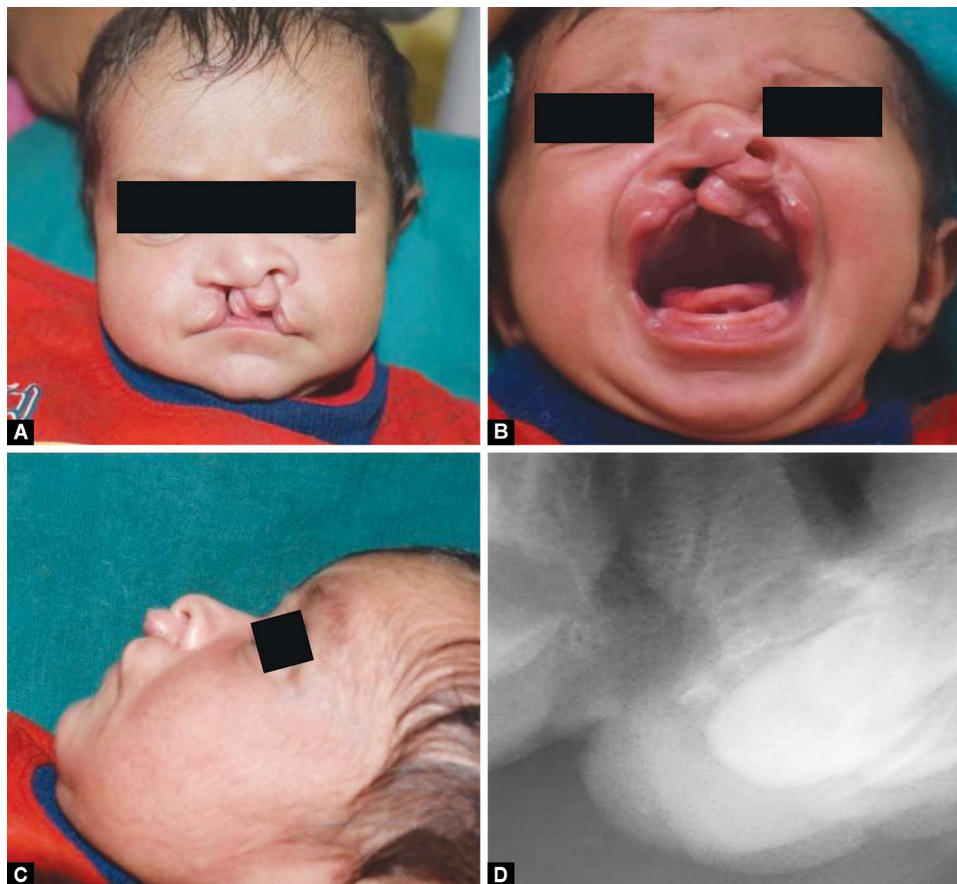
The PNAM appliance was fabricated on the working model. Undesirable undercuts were blocked out. A clear autopolymerizing acrylic resin plate of 2–3 mm thickness was fabricated. Intraorally, the

extension of the plate was verified and all the overextensions and rough surfaces were removed. The retention button was planned to provide anchorage to the molding plate and positioned at an angle of a 45° plate (Fig. 3A). A small, circular hole of approximately 6 mm was made in the posterior back area of the palatal coverage. It was to serve as a safety feature to permit breathing in case of accidental dislodgment of the appliance and the resultant complete blockage of the pharynx.

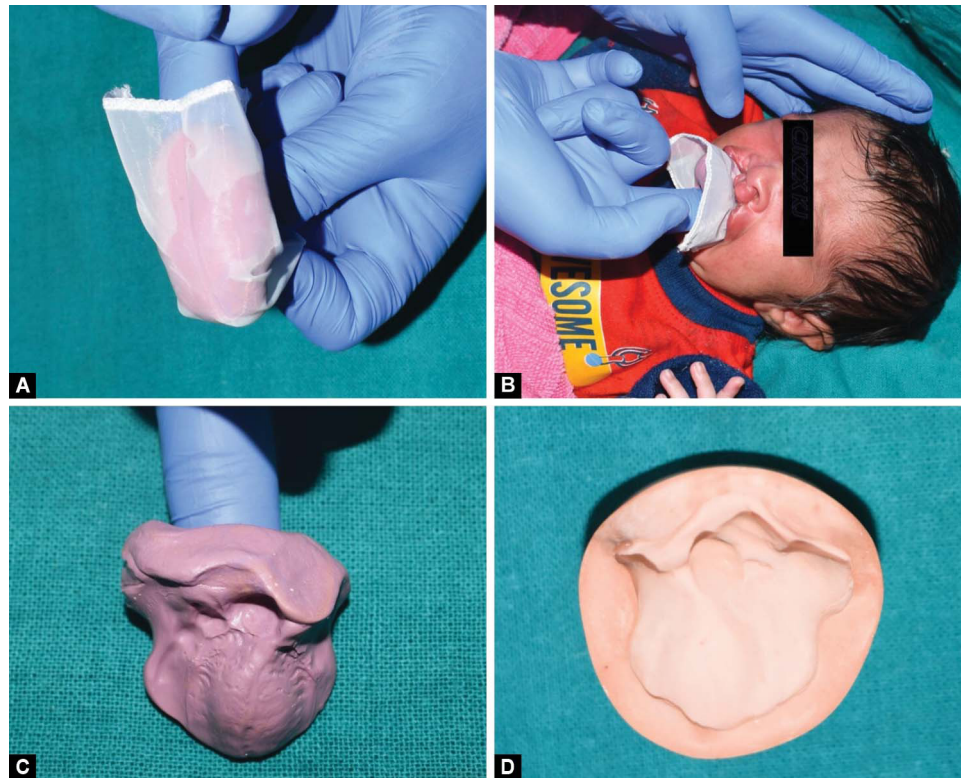
Insertion of the Appliance and Lip Taping

Adhesive tape (3M Tegaderm HP, India) and a soft strap were used for extraoral attachment. Stainless steel small-prefabricated hooks were attached to each end of the string of soft elastic masks. The soft elastic round mask string was taken from the N95 face mask. Each end of the modified string was utilized to encircle the head at the occipital area, and its position on the cheek was maintained through the use of adhesive tape to avoid sliding over the convexity of the cheek. Extraoral heavy elastics (inner diameter 0.25 inch, wall thickness heavy) were utilized to anchor the appliance in position and deliver the forces on the segments. The forces were measured using the Dontrix gauge. Two elastics on each side of the midline were engaged with a retention button onto the midline and stainless hooks on the other hand (Figs 4A to C).

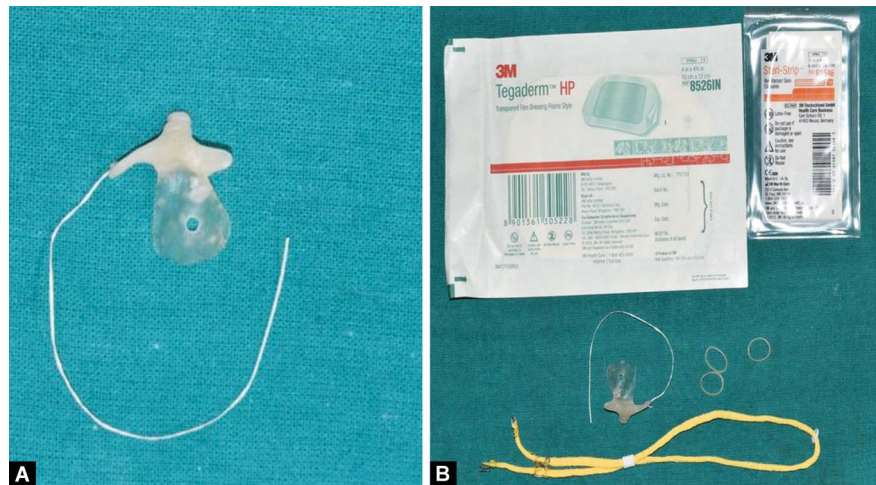
To achieve soft tissue molding over the lip area, 3M Steri-Strip (a quarter inch in width and about 3–4 inches in length) tape was secured over the area extending from midline to the cheek after securing the segments in the most feasible approximated position (Fig. 4D). Parents were instructed to keep the appliance for full-time



Figs 1A to D: (A and B) Preoperative frontal view; (C) Preoperative left lateral view; (D) Radiographic view



Figs 2A to D: (A) Muslin cloth placed over mixed impression material; (B) Impression making; (C) Obtained impression; (D) Master Stone model



Figs 3A and B: (A) PNAM appliance; (B) Materials used for extraoral anchorage and PNAM appliance

use. They were demonstrated the insertion and removal of the appliance, and instructed to maintain the hygiene of the appliance and oral cavity.

Adjustment of Appliance

Weekly follow-up was done to adjust the molding plate to approximate the major and minor segments together. At each follow-up, the oral cavity was examined carefully for sore spots and soft tissue blanching. The extraoral indirect relining technique was used to accommodate the changes. Light body impression material was used with the existing plate to make the impression. Extraoral relining was done with soft tissue relining material (Fig. 5).

Incorporation of the Nasal Stent

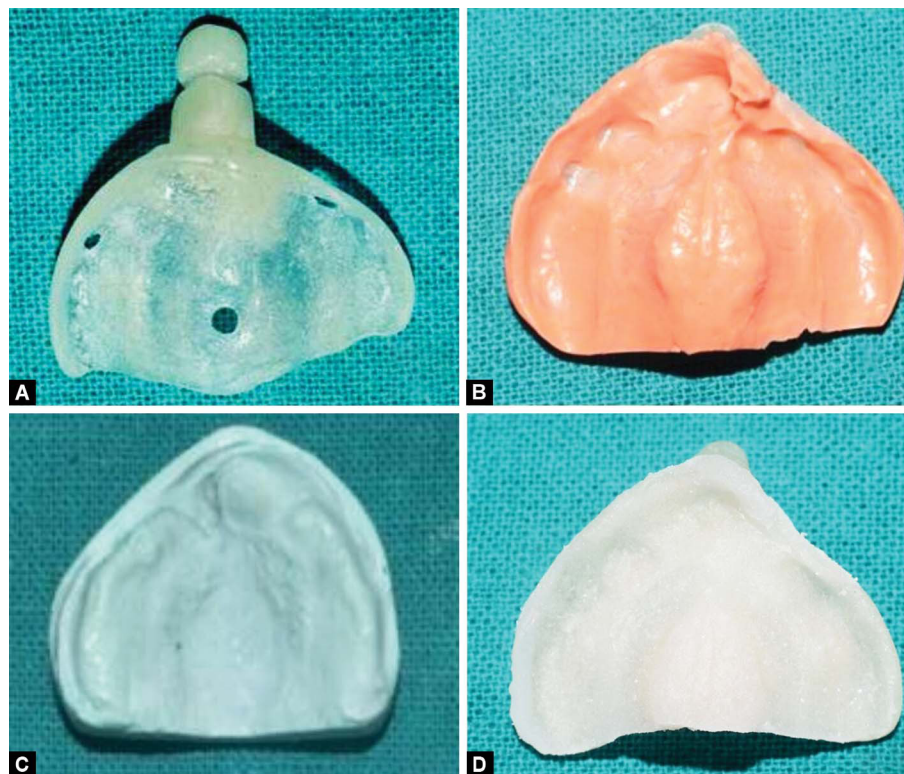
The nasal stent was made in the shape of a swan neck with 0.36 inch round stainless steel wire with padding of acrylic resin. A layer of soft tissue relining material was added onto the hard acrylic lobe; the stent was attached to the labial flange of the molding plate. It was extended and curved backward and was placed 3–4 mm deep into the nostril aperture (Fig. 6). A significant approximation of the cleft segments was achieved in 4.5 months (Fig. 7).

Primary Surgical Repair of the Alveolus, Lip, and Nose

After completion of PNAM, the primary surgical closure of bilateral lip alignment with primary rhinoplasty was performed at the age of 4.5 months under general anesthesia (Fig. 8). Due to proper



Figs 4A to D: (A) The strap of PNAM was positioned with a three wire hook clasp with the eye; (B) Force was measured with a Dontrix gauge; (C) PNAM appliance *in situ*; (D) Lip taping

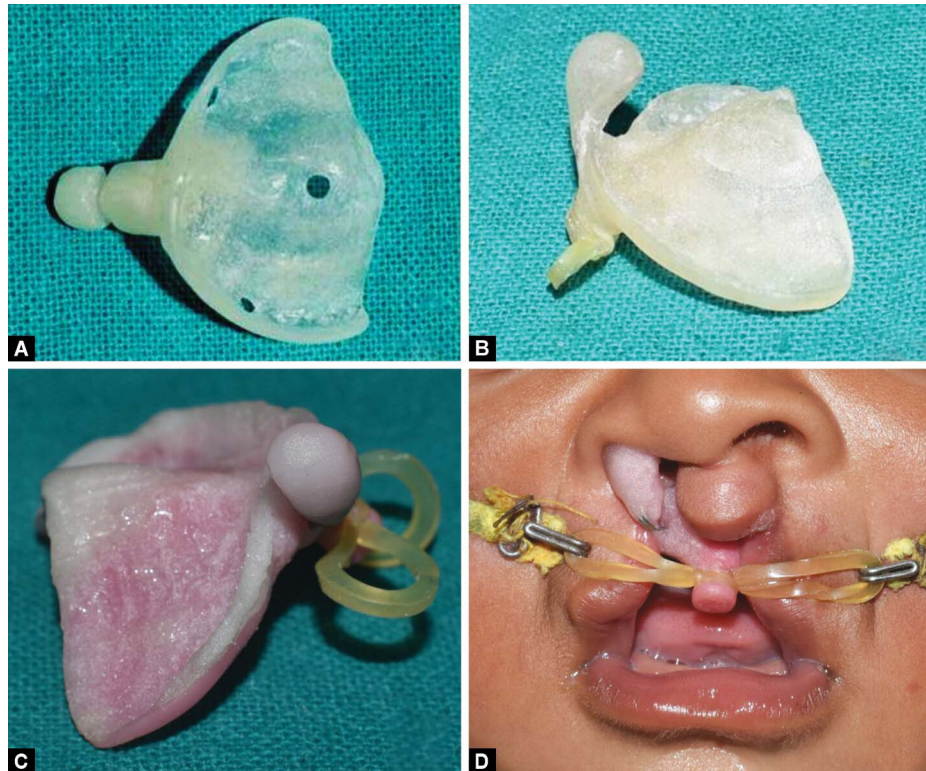


Figs 5A to D: (A) Previous PNAM plate; (B) Final impression taken into the existing plate; (C) Plaster model; (D) Relined PNAM

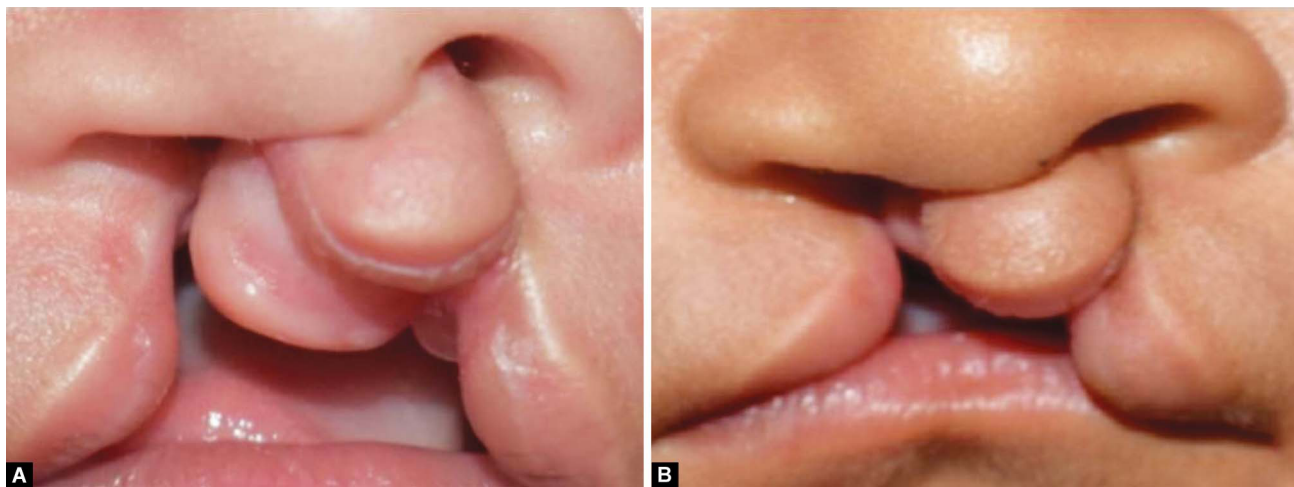
alignment of major and minor segments as well as soft tissue around the nose, there was a minimal need of dissection and advancement of local tissue with tension-free closure of the cleft.

Follow-up

After surgery, the patient was scheduled for a monthly follow-up. During the 6 months of follow-up, the child's parents did not



Figs 6A to D: (A) Previous PNAM plate; (B) Addition of nasal stent to PNAM plate; (C) Addition of soft denture liner onto the tip of the nasal stent; (D) PNAM plate with a nasal stent *in situ*



Figs 7A and B: (A) Before PNAM; (B) After PNAM

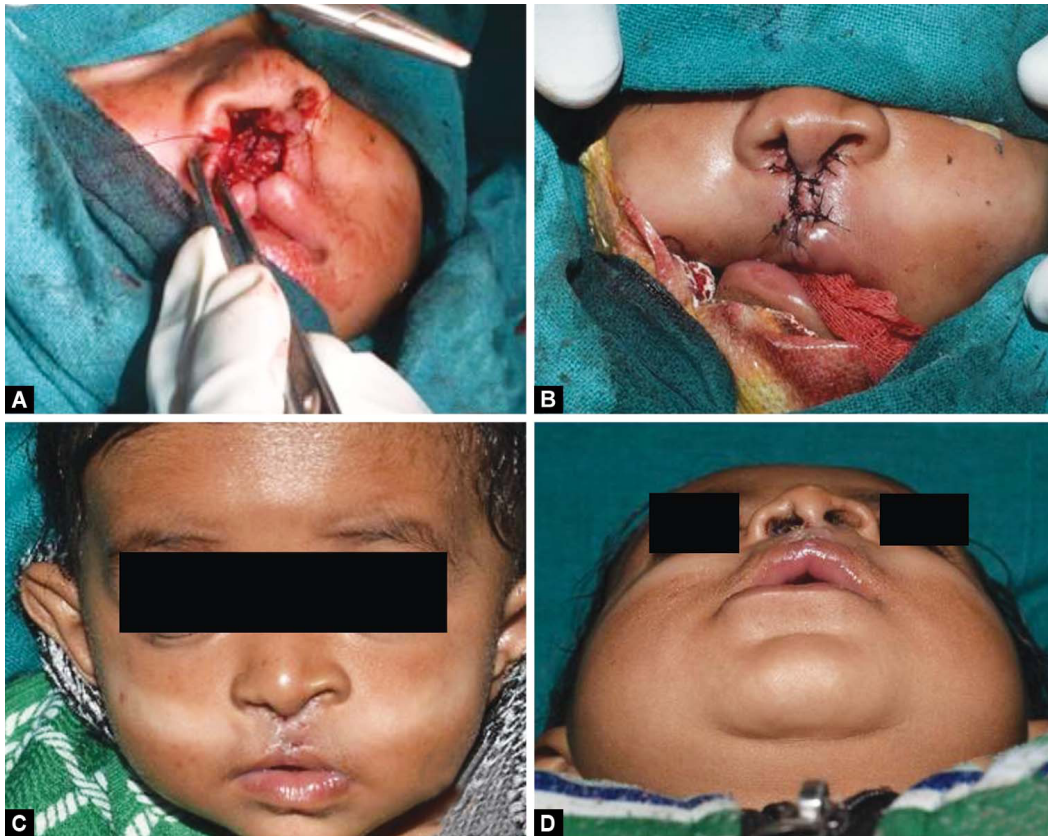
complain of any feeding problems, and a marked weight gain in the child was observed. The next surgical correction was scheduled at the age of 4 years.

DISCUSSION

Higher levels of estrogen at the time of birth correlate with the increased amount of hyaluronic acid, which inhibits the linking of the cartilage intercellular matrix. The nasoalveolar molding is based on the principles of application of continuous light force that results in the reshaping and recontouring of alveolar and nasal cartilage. Spengler et al. and Ezzat et al. concluded that

PNAM significantly increases surgical outcomes by decreasing the gap between the alveolar cleft, reshaping the arch symmetry, decreasing in columellar angle deviation, and maintenance of the bialar width of the nose.⁴ Similar results were achieved in this case.

The impression material of choice was soft putty polyvinyl siloxane impression material (3M ESPE, India) as it has excellent surface recording properties, high tensile, and shear strength that prevents the tearing of impression material while removing it from the undercut area.⁵ Mixed impression material was covered all around with muslin cloth to act as a safety mechanism to prevent accidental swallowing of the unset material. For the extraoral anchorage of the



Figs 8A to D: (A and B) Immediate postsurgical closure view; (C and D) 1-week postsurgery frontal and duck view

plate, an innovative anchorage was planned and fabricated using a mask strap and stainless steel hook. A hole was made in the anterior portion of the molding plate and dental floss was tied to prevent any accidental swallowing of the molding plate. A small circular hole of approximately 6 mm was made in the posterior part of the molding plate to provide an emergency airway during accidental dislodgment of the molding plate. To prevent the thermal burn during the relining procedures, the extraoral relining technique was used, a plaster index was made, and relining was done extraorally. In view of the child's age, patient compliance was negligible; hence mechanical retention was adopted. It was achieved through innovative, customized retention headgear suitable for infants.

Properly and well-coordinated PNAM provides an excellent approximation of soft tissue around the defect area, provides the plastic surgeon with a minimal need for local tissue dissection, and thus provides better outcomes in surgical procedures.

CONCLUSION

Presurgical nasoalveolar molding (PNAM), if executed in a structured and well-coordinated manner aligns and recontours the structure associated with CLP, and hence better outcome results can be expected. The coherent planning of the surgical and prosthetic phases resulted in requisite outcomes.

CLINICAL SIGNIFICANCE

The higher level of estrogen and hyaluronic acid in the newborn that remodels the cartilage can be utilized through the light application of forces, and hence hard and soft tissue molding can be achieved without surgery. PNAM acts as a promising adjunct prior to primary surgical closure of the CLP. Thus, PNAM immediately after birth can serve to significantly augment the surgical outcomes and the extent and/or the number of surgeries can be reduced.

REFERENCES

1. Mossey P, Little J. Addressing the challenges of cleft lip and palate research in India. *Indian J Plast Surg* 2009;42(Suppl):S9–S18. DOI: 10.4103/0970-0358.57182
2. Fisher MD, Fisher DM, Marcus JR. Correction of the cleft nasal deformity: from infancy to maturity. *Clin Plast Surg* 2014;41(2):283–299. DOI: 10.1016/j.cps.2014.01.002
3. Grayson BH, Shetye PR. Presurgical nasoalveolar molding treatment in cleft lip and palate patients. *Indian J Plast Surg* 2009;42 Suppl(Suppl):S56–S61. DOI: 10.4103/0970-0358.57188
4. Deshpande A, Shah D, Macwan CS. Presurgical nasal molding in a neonate with cleft lip. *BMJ Case Rep* 2014;2014:bcr2013201989. DOI: 10.1136/bcr-2013-201989
5. Pani SC, Hedge AM. Impressions in cleft lip and palate—a novel two stage technique. *J Clin Pediatr Dent* 2008;33(2):93–96.